

ABSTRACT OF THE DISCLOSURE

A hydrogen storage and delivery system is provided having an orifice pulse tube refrigerator and a liquid hydrogen storage vessel. A cooling system, coupled to the orifice pulse tube refrigerator, cools the vessel and abates ambient heat transfer thereto in order to maintain the liquid hydrogen in the vessel at or below its saturation temperature. Hydrogen boil-off, and the necessity to provide continuous venting of vaporized hydrogen are minimized or avoided. In a preferred embodiment, the hydrogen storage vessel has a toroidal shape, and the pulse tube refrigerator is a two stage pulse tube refrigerator and extends within a central void space defined at the geometric center of the toroidal storage vessel. Also in a preferred embodiment, the cooling system includes first and second thermal jackets, each having a substantially toroidal shape and enclosing the storage vessel, wherein each of the thermal jackets is thermally coupled to one of the first or second stages of the pulse tube refrigerator in order to cool the vessel and to abate ambient heat leak thereto. The hydrogen storage and delivery system is particularly suitable for use in vehicles, such as passenger automobiles.